

Preferred numbers

Confirmed
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Co-operating organizations

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- Associated Offices' Technical Committee
- Association of Consulting Engineers
- Association of Mining Electrical and Mechanical Engineers
- Board of Trade
- British Chemical Plant Manufacturers' Association
- British Compressed Air Society
- British Electrical and Allied Manufacturers' Association*
- British Gear Manufacturers' Association
- British Internal Combustion Engine Manufacturers' Association
- British Iron and Steel Federation
- British Mechanical Engineering Federation
- British Railways Board
- Crown Agents for Oversea Governments and Administrations
- Electricity Council, the Generating Board and the Area Boards in England and Wales
- Engineering Equipment Users' Association*
- Gas Council
- Institute of Marine Engineers
- Institution of Civil Engineers
- Institution of Gas Engineers
- Institution of Heating and Ventilating Engineers
- Institution of Mechanical Engineers
- Institution of Mechanical Engineers (Automobile Division)
- Institution of Production Engineers
- Locomotive and Allied Manufacturers' Association of Great Britain
- London Transport Board
- Machine Tool Trades Association
- Ministry of Defence, Army Department
- Ministry of Defence, Navy Department
- Ministry of Labour (H.M. Factory Inspectorate)
- Ministry of Power
- Ministry of Public Building and Works
- Ministry of Technology — National Engineering Laboratory
- Ministry of Transport
- National Coal Board
- National Physical Laboratory (Ministry of Technology)
- Radio Industry Council
- Royal Institute of British Architects

The scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Electronic Engineering Association
- National Federation of Engineers' Tool Manufacturers
- Radio and Electronic Component Manufacturers' Federation
- Woven Wire Association

This British Standard, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 10 August 1965

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Contents

	Page
Co-operating organizations	Inside front cover
Foreword	ii
Introduction	1
1 Scope	2
2 Derivation	2
3 Nomenclature and definitions	3
4 Designation	3
5 Series of preferred numbers	3
6 Choice of series	6
7 More rounded values of preferred numbers	7
Appendix A International examples of the use of preferred numbers	9
Appendix B Recommendations for calculating with preferred numbers	10
Table 1 — Basic series of preferred numbers	4
Table 2 — Derivation of basic series	5
Table 3 — R80 series of preferred numbers for exceptional use	6
Table 4 — More rounded values of preferred numbers	8

Foreword

When BS 2045 was first published in 1953 it was stated that its objects were a) to give authoritative status to preferred numbers for application, where appropriate, in British practice, and b) to provide readily accessible information on the numbers themselves for those who have occasion to use them. The numbers were those agreed internationally by the International Organization for Standardization (Technical Committee ISO/TC.19, Preferred Numbers) and published as ISO Recommendation R3.

Since that date, United Kingdom participation in the work of ISO Committees has brought increasing awareness of the extent to which preferred numbers may be used for a variety of products. The more numerous the applications for which these series of numbers may be used, however, the more necessary it is to ensure that they are selected to the best advantage from a practical as well as from a theoretical point of view. To this end, ISO Recommendation R17, "Guide to the use of preferred numbers and of series of preferred numbers" was published in 1956 and the present revision of the British Standard takes account of that Recommendation.

Mention should also be made of BS 1638, "*Report on the selection of ranges of types and sizes (Preferred Numbers)*", published in 1950, in which the late Mr. J. E. Sears, C.B.E., discussed the technical advantages and practical applications of preferred numbers. In dealing with the subject, Mr. Sears referred to other series of preferred numbers which were in use at the time; since then, the countries concerned have accepted ISO Recommendation R3 and it is felt that in general future consideration of preferred numbers should be confined to the Renard series given in that Recommendation. Mention should, however, be made of the fact that series known as the "E" series are still in wide use in the electrical industry and appear in some of the publications issued by the International Electrotechnical Commission (IEC).

BS 1638 has now been withdrawn, but it is thought that much of Mr Sears's general explanatory matter would still be helpful to potential users of preferred numbers and part of it has therefore been incorporated in the Introduction to this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 11 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

When planning the production of any commodity, there are a number of factors which must be taken into account in deciding the number of different sizes for which provision must be made. The demand of consumers for a very wide range of choice has to be balanced against any increase in the costs of production, stocking and distribution, which may result from the production of many sizes and types.

Experience has shown that the consumer's requirements are frequently found to be satisfied when the range of sizes follows more or less closely a geometrical progression, even though the selection has been made without any dictation from theory.

When a standard is in course of preparation and the subject calls for a range of sizes, an appropriate procedure would be, first to determine what are the smallest and the largest sizes required and how many intermediate sizes are needed, and then by a simple calculation to set out a table of sizes, each being approximately a uniform percentage larger than its predecessor.

In order to secure some measure of uniformity of practice in the choice of sizes, a number of countries has adopted as standard the use of one or other of the following ranges, all of which include the numbers one, ten, one hundred, etc.:

- a) Five steps in each decade.
- b) Ten steps in each decade.
- c) Twenty steps in each decade.
- d) Forty steps in each decade.
- a) Largest 10 times the smallest in 5 steps.
- b) Largest 10 times the smallest in 10 steps.
- c) Largest 10 times the smallest in 20 steps.
- d) Largest 10 times the smallest in 40 steps.

An explanation of the derivation of these series is given in Clause 2 below, but it may be mentioned here that they are intended for application in all those fields where a scale of numbers is necessary and are designed to present certain characteristics which it is considered essential that such numbers should possess; namely that they should:

- i) be simple and easily remembered,
- ii) be unlimited both towards the lower and higher numbers,
- iii) include all the decimal multiples and sub-multiples of any term,
- iv) provide a rational grading system.

The theoretical numbers, suitably rounded off for practical convenience, as explained in Clause 2, are known as "preferred numbers"; alternatively, they are often referred to as "Renard numbers" as a tribute to the French engineer, Col. Charles Renard, who first proposed their use and the various series include "R" in their designations, e.g. R5, R10, etc.

The field of use for preferred numbers is of the broadest kind, and they can be applied with advantage either to the grading of complete articles by length, area, volume, weight, power rating, and so on, or to the individual dimensions of component parts in engineering designs. Some specific applications are described in Appendix A.

It must be emphasized that the object of formulating an agreed series of preferred numbers is to provide the designer with a guide which, while not operating to restrict his liberty of choice for the essential purposes of his design, will serve to minimize unnecessary variations of sizes. The mere suggestion of any such limitation of choice is bound to give rise to misgivings as to its possible reaction on the freedom of the designer to meet the conditions of any particular problem in the most effective manner. But without the guidance afforded by a series of preferred numbers, individual designers will tend to vary widely, though often without real necessity, in their choice of many features of design, whereas the general adoption of preferred numbers, where applicable, tends to foster uniformity of practice in respect of those factors of design where it is likely in the long run to be advantageous.